CREATING AND ADAPTING JOBS IN EUROPE IN THE CONTEXT OF A SOCIO-ECOLOGICAL TRANSITION

USELESS DEGREES OR USELESS STATISTICS?

A COMPARISON OF THE NET PRESENT VALUE OF HIGHER EDUCATION BY FIELD OF STUDY IN FIVE EUROPEAN COUNTRIES

MIROSLAV BEBLAVÝ, SOPHIE LEHOUELLEUR AND ILARIA MASELLI

NEUJOBS WORKING PAPER NO. D4.4.2.A

JULY 2013

Abstract

With higher education increasingly available to young people regardless of their socio-economic status, the question "what to study" is steadily replacing "whether to study" as the key question facing students today. This paper examines, in a comparative and methodologically innovative manner, incentives for studying various fields measured by net present value of university education. We use data from five European countries (France, Italy, Hungary, Poland and Slovenia) and include (opportunity) costs in the computation. Results suggest that enrolling in STEM (science, technology, engineering and mathematics) faculties is often not the best bargain, especially for female students. Decisions made by students are therefore consistent with their private returns, which points to the fact that if policy-makers desire to induce changes in behaviour, they should consider changing the incentives themselves.

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1. Introduction and motivation

When higher education was reserved primarily as a pursuit of elites, what mattered most was participation in tertiary education rather than the particular area of study. Since 1960s, however, Europe has experienced a gradual 'massification' of its higher education, with the European Union recently setting itself a goal of graduating 40% of young people with higher education degrees by 2020 (in the 30-34 year old age cohort). It is reasonable to expect that as the group of university graduates grew bigger, within-group heterogeneity also increased in the sense that different labour market outcomes can be expected for graduates from different faculties. To what extent has Europe achieved that ambition and if so, what are the policy implications?

Policy-makers and policy analysts at the European level appear to have clear answers, which point them towards science, technology, engineering and mathematics (STEM) as scarce and preferable choices. As emphasised in EUROPE 2020, the EU's flagship policy strategy document: "At national level, Member States will need to ensure a sufficient supply of science, maths and engineering graduates."[1] This is based on research that shows that "the current supply of STEM skills is considered to be insufficient and when combined with forecast growth in demand for STEM skills, these shortages present a potentially significant constraint on future economic growth in Europe."[2] At the same time, applied research emphasises that "those with specific degrees do better than those with more general degrees (arts and humanities)".[3]

The choice of a field of study also has a gender dimension. While women represent a majority of the students enrolled in tertiary education today, the share of female students in science, technology, engineering and mathematics remains only around one-third, with relatively little variation across different countries (see Table 1). The European Commission recently linked the fact that "there are great differences in the choice of study field between women and men" to "a key challenge for Member States and for higher education institutions to attract a broader cross-section of society into

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1 European Commission (2010), p. 11.

2 European Commission (2012a), p. 6.

3 CEDEFOP (2010), p. 11.

higher education".[4] The European Commission even described the need to make STEM education more attractive to women as "a well-known… challenge".[5]

Table 1. Proportion of female graduates in STEM as a share of all graduates, 2010

Country	%
EU (27 countries)	33.3
France	28
Italy	39.8
Hungary	30.1
Poland	39.4
Slovenia	30.1

Note: Data for France and Italy are taken from 2008.
Source: Eurostat.

This leads to a puzzle: while the study of 'hard' subjects, such as STEM, offers better employment and pay prospects, the interest shown by students in these subjects is 'insufficient'. This seeming illogicality suggests irrational decision-making by students or a lack of relevant information or, in the case of women and STEM, to an unfortunate legacy of the past.

Our paper aims to partially solve the puzzle using data from five European countries (France, Italy, Hungary, Poland and Slovenia). We contend that the current research examines only part of the equation because it tends to look at only SOME of the benefits (employment prospects and the salaries of graduates). Private returns to education should include a broader set of variables. The key variable is the different cost of study to students in terms of the necessary time commitment, which heavily influences their opportunities for working while studying. We demonstrate that once these factors, together with the post-graduation salaries and a proper discount rate, are included in a student's calculation, much of the puzzle is explained. In the short- to medium-term after the graduation, STEM careers do not make as much financial sense as the headline numbers seem to suggest and this is particularly true for women. On the other hand, social studies do make sense, thanks to the combination of good returns and low costs. Our findings seem to suggest both an important methodological innovation and its policy application.

This paper is organised as follows: section 2 reviews the literature, section 3 explains in detail the methodology and in section 4 we present our results. In the final section we provide concluding remarks and policy recommendations.

2. Literature review

There is abundant literature on the rate of return to education, which started with the work of Becker (1964) and Mincer (1974) and has since become increasingly sophisticated. We are interested in particular in two growing branches.

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[4] European Commission (2012c), p. 22.

[5] Ibid., pp. 3-4.

The first one investigates returns by field of study. It develops the idea that as tertiary education expands, not only the level, but also the nature of human capital explains the differential in the productivity of individuals. As emphasised by Dickson & Harmon (2011), looking at average values is no longer satisfactory: many sources of heterogeneity indeed exist, such as blacks versus whites (Handerson, Polachek & Wang 2011) or natives versus immigrants (Park 2011). The second stream of the literature tries to compute returns by using alternative methods to the traditional Mincer approach by borrowing indicators from the financial world, such as the internal rate of return of the net present value (NPV hereafter).

We focus on private returns to education – what an individual gets out of an education (from a financial point of view). Early studies with a breakdown of returns by field of study focused essentially on North America,[6] and the UK.[7] Some recent studies focus on continental Europe, including Germany (Kim & Kim 2003; Grave & Goerlitz 2012), France (Goudard & Giret 2010), Italy (Buonanno & Pozzoli 2009), Greece (Livanos & Pouliakas 2008), Ireland (Kelly, O'Connell & Smyth 2010), Slovenia (Bartolj, Ahcan, Feldin & Polanec 2012) and the Czech Republic (Münich, Svejnar & Terrell 2005). Studies are often conducted at the national level and for this reason can hardly be compared. Overall, they tend to find that returns to science and technical fields outpace those in education, arts and humanities.

Using data from the European Labour Force Survey (2004-2005) in 22 European countries, Reimer, Noelke and Kucel (2008) show that humanities graduates have a higher unemployment risk than graduates from other fields. Moreover, the larger the numbers of students who graduate from university, the greater are the differences in labour market opportunities of university graduates from different fields.

If we accept the idea that education is an investment in one's future, the risk element should not be ignored. Secondary school graduates need to take a number of decisions with limited information when they apply for university: they assess their risk of dropping out, calculate costs, evaluate gains in terms of labour market opportunities and try to figure the future impact of technology. All these elements might have an impact on the choice of the field of study. Fields allowing high wages are typically considered more challenging and characterised by higher drop-out rates (De Paola & Gioia 2012; Montmarquette 2001; Leppel 2001). De Paola & Gioia (2012) find that risk-adverse students are more likely to enrol in humanities or engineering rather than social sciences. In particular, the more able ones will sort themselves into engineering where dropout rates are more elevated but so also are wages and probabilities of employment, whereas the less able will gravitate towards the humanities track to be confident of completion.

The literature on fields of study also examines gender differences. Indeed, a part of the gender gap can be explained both by differences in qualifications between gender groups and by differences in wages for individuals with similar qualifications.

[6] Vaillancourt (1995); Stager (1996); Arcidiacono (2004); Finnie & Frenette (2003) and Stark (2007).

[7] Blackaby, Murphy & O'Leary (1999); Blundell, Dearden, Goodman & Reed (2000); Bratti & Mancini (2003); O'Leary & Sloane (2005); Walker & Zhu (2011) and Chevalier (2011).

Analysing the returns of education by field of study allows us to test for these two aspects. Kim and Kim (2003) observe that women and men are asymmetrically distributed across fields of study with women more concentrated in fields of study such as humanities, education and business, which offer lower lifetime earnings, compared to men, who are more represented in fields such as mathematics, engineering and natural sciences. Such form of segregation varies dramatically across countries. Interestingly, Scandinavian countries show the highest rate of segregation, especially in engineering and natural sciences (Bradley 2000).[8] Controlling for majors in the UK and Germany, Machin & Puhani (2003) found that subject selection explains between 9 to 19 percent of the gender wage differential among graduates, which is consistent with the findings from Livanos & Pouliakas (2008) – 8.4% for Greece. By assessing this results with a cohort approach, O'Leary & Sloane (2005) for UK and Finnie & Frenette (2003) for Canada show that the influence of the choice of major on the gender wage gap has decreased considerably since the 1970s, while educational choices of women have converge towards those of men. However, even if we still observe a slight but continuous increase in the share of females in traditionally male-dominated fields, the segregation remains remarkably stable (Kim & Kim 2003; Bradley 2000), and can only explain an increasingly marginal part of the gender gap (O'Leary & Sloane 2005).

This convergence pattern in the gender gap followed a different path in transition countries. As noted by Gáti & Róbert (2011), in Poland, Hungary and Slovenia, similarly to Western Europe, women are overrepresented in the fields of social sciences, health, business, economics and law. Early in the transition, this had a positive effect on reducing the gender gap thanks to the small supply of these professions. And as a consequence, the position of female graduates in the labour market improved in Bulgaria (Giddings 2002), Estonia and Slovenia (Orazem & Vodopivec 2000). However, in the long run, this early advantage has slightly disappeared, also driven by increasing earning differences within fields (Bartolj et al. 2012).

3. Methodology

The most common method used in the literature to calculate return on education is the econometric approach through the so-called 'Mincer equation', which estimates the impact on wages of an additional year of schooling. This procedure does not come without problems, in particular the endogeneity associated with cognitive abilities of the individual, which can hardly be measured. In this case, more able students might select themselves into more difficult majors. Kelly, O'Connell & Smyth (2010), for instance, find that for the more able students, the field of study has a marginal effect on earnings.

Another critique goes to the non-consideration of costs of education, which can strongly influence educational decisions (Usher 2005). Boarini & Strauss (2010) compare the private rate of returns in 21 OECD countries and find that even if the labour market premia is the main driver of returns, other components have non-

[8] The reason for the different choices of women is unclear; for a review, see Kim & Kim (2003).

negligible effect due to the fact that costs, duration for studies and taxation rates vary a lot between countries.

A more recent approach to the study of returns consists in borrowing financial indicators and can be labelled as "an investment approach" (OECD 2012). This has two main advantages; on one hand, instead of a "wage premium", NPV compute a "labour market premium". This enables the examination of the different component of IRR/NPV, in particular the effect of costs, study length and the probability of employment (Martins, Boarini, Strauss & de la Maisonneuve 2009).

Overall, as OECD (2012, p. 167) explains:

> Apart from availability of data, the main difference between the two approaches is that the investment approach is forward-looking (although historical data are typically used), whereas an econometric approach tries to establish the actual contribution of education to gross earnings by controlling for other factors that can influence earnings and returns… As the investment approach focuses on the incentives at the time of the investment decision, it is prudent not to remove the effects of (controlling for) other factors such as work characteristics, as these are not known ex-ante and could be seen as part of the average return that an individual can expect to receive when deciding to invest in education.

In order to study private returns by field, we calculate the Net Present Value (NPV) of university study by field. The most ambitious and comprehensive estimate of private (and public) returns to education using the net present value approach has been published for several years by OECD. We generally follow their methodology with two caveats which also constitute the main value added of this paper:

- The OECD does NOT distinguish between the various fields in presenting its data, but rather calculates a single value for each country, differentiated only by gender. Our paper focuses on differences by fields of study.
- Our paper factors in time use, meaning that we use information on how many years students remain in education and how many hours they spend on books/in classes and in small jobs. We use this information to calculate the opportunity cost: we assume the amount of hours a student spends studying is the same that s/he would work if they were not students.

In other words, we include, on the cost side, direct costs of education and foregone earnings. On the benefit side, we include gross earning benefits, the income tax effect and social security contribution effect.

We also base our estimate on actual earnings data from the 5-year period following graduation rather than estimate a lifetime profile as the OECD and other studies do. The disadvantage of this approach is that it provides only a short- to medium-term view. However, the advantage is that since lifetime earnings data are not available by fields of study, any imputation would be essentially guesswork. Additionally, if we are primarily interested in students' choices, then the 8-11 year horizon of costs and benefits this provides (time spent studying + 5 years after) is relevant given the likely high lifetime discount rates and limited horizons. We also utilise the results cautiously, looking not at the numerical values themselves, but their relative positions and differences.

We rely primarily on survey data collected in the HEGESCO and REFLEX projects in which more than 43,000 graduates have been surveyed 5 years after their graduation in 20 countries. Reference populations are the 2000 cohort of graduates in France and Italy (surveyed in 2008) and the 2002-03 cohort in Hungary, Poland and Slovenia (surveyed in 2008). We complement them with data drawn from the European Labour Force Survey (aggregate data accessible online).

Overall, we proceeded in the following way: we created two periods: during university and after graduation. The latter lasts always approximately 5 years, the former depends on the duration of studies, which goes from 3 to 6 years. We discounted each year at a 3% rate.[9]

Consequently, to compute the private net present value we use the formula:

$$\sum_{t=1}^{y+5} \frac{A_{f,g} - B_{f,g}}{\{(y_{f,g} + 5) + r\}^{y_{f,g}+5}}$$

With y being the sum of number of years in education, *A* and *B* respectively net cash-flow after and before graduation and *r* the discount rate. For the period during university, we sum the following variables: foregone earnings multiplied by the probabilities of employment for non university graduates (OC), universities fees net of grants (NF), labour earnings during studies (SLI).

$$B_{f,g} = SLI_{f,g} - NF \quad - OC_{f,g}$$

$$SLI_{f,g} = MW_{f,g} * MI^{95-98}{}_{g}$$

Students' labour income (SLI) is the result of the number of months worked in the pre-graduation period (MW) multiplied by the monthly median net income of a male / female aged 16-24[10] in 1995 in France and Italy and in 1998 in the other three countries. Information on the number of months worked during studies comes from REFLEX / HEGESCO.[11]

$$NF \quad = (fees^{95-98} - grants^{95-98}) * (y_{f,g})$$

Net fee (NF) is the difference between fees and grants, multiplied by the number of years in education (y). As the reference source for this information, we rely on a report for the European Commission which gives an overview of public fees and support system in Europe (European Commission 2012b). The report refers to 2011-12 fees and grants. We assume that no major change occurred in the fee structure and simply apply

[9] We borrow this figure from the OECD (2012).

[10] A further clarification is needed here: Eurostat provides annual average earnings of 16-24 years old, by gender. We obtain the hourly value by dividing it by 12 months, four weeks and 40 hours per week. We achieve a number in the range of 6 euros / hour for males and 5 for females in Italy, 7 and 6 respectively in France, 3 in Slovenia, 1 in Hungary and Poland.

[11] Questions are B3 / B4: we total the study- and non-study-related paid work during education.

inflation rate to obtain the equivalent fee in 1995-98 prices. We do not distinguish by field in this case.

$$OC_{f,g} = \{(HS_{f,g} * I^{95-98}{}_{g}) * Empl\ prob\ Isced3_{g}^{95-98}\} * (y_{f,g})$$

Our choice of how to compute the opportunity cost is peculiar: to calculate how much students from each field (and by gender) would have earned if they chose full-time work instead of university, we assume that their supply of work equals the number of hours they actually spent studying (whether in class or individual study hours). We multiply these hours by the median net income of a 16-24 years old and the probability of employment of a person in the same cohort that stopped his/her education at high school level. Such result is then multiplied for the duration of studies. Such formulation results in opportunity costs differentiated by both field and gender. They range from -4,000 euros in Poland and Hungary to -20,000 in France and Italy.

For the period after graduation we subtract from earnings the cost of the month of transition to the first job and the salary of a person without education in the same age.
$A_{f,g} = LI_{f,g} - T_{f,g} - OC_{g}$

Labour income after graduation (LI) is calculated as gross salary multiplied by the number of months in employment and the probability of employment. Data come directly from HEGESCO/REFLEX. A tax rate is applied to the gross salary using tax rates for single-parent, high-earners, which can be downloaded from Eurostat.[12]

T refers to the transition from school to work (normally less than three months) and is calculated as an opportunity cost. For the period after graduation, we also subtract what the same person would have earned if s/he continued to work after school and multiply that by the probability of employment of ISCED3 graduates in 1999-2000 in France and Italy and 2003 for Poland, Hungary and Slovenia.

We compute NPVs for five countries: Italy, France, Hungary, Poland and Slovenia. In each, the gross number of observation ranges from 1,200 in Poland to 3,139 in Italy. We do not consider the Bachelor/Master division for two reasons. First, it is not applicable in the case of Poland, France and Italy: the 3+2 reform was implemented after people surveyed started university. Secondly, in the two remaining countries, such a distinction would in principle be possible but it is not considered due to the very small number of master-degree graduates.

Once only those gradates whose wages are recorded are considered,[13] the number falls to, on average, 160 observations by field and gender. Data are organised by nine fields of study which we group into four to have a sufficient number of observations in each: i) education, arts and humanities, ii) social science, business and law, iii) STEM (science, mathematics, computing, engineering, manufacturing and construction) and

[12] The source for Eurostat is the OECD.

[13] Plus those whose wages are bigger or smaller the average +/- 3 times the standard deviation.

iv) what we call health & related services, which include agriculture, veterinary, services, health and welfare.[14] All values are averaged for each field of study.

Table 2. Number of observations by country, gender and field of study

		France	Italy	Hungary	Poland	Slovenia
Education, Arts & Humanities	M	29	37	60	23	52
Social Science, Business & Law	M	97	294	92	114	246
STEM	M	154	349	114	164	236
Health & Related Services	M	23	83	59	70	153
Education, Arts & Humanities	F	181	206	176	141	335
Social Science, Business & Law	F	224	347	149	245	613
STEM	F	164	178	70	89	118
Health & Related Services	F	75	148	136	88	300

Source: Authors' elaboration based on HEGESCO / REFLEX datasets.

With this methodology we compute the monetary net present value of tertiary education. For male graduates it ranges from 2,000 euros in Italy for STEM graduates to 33,000 euros for social scientists in Poland. For female students, it is on average lower, even negative for Italian STEM graduates, but can also reach 27,000 euros in Poland and 23,000 euros in Hungary for social scientists. The computed NPVs are higher in Central and Eastern European countries compared to Western Europe. The reason is that these countries enjoyed a sustained economic growth in general during the decade covered by the surveyed, generating a generalised growth of wages and prices. Moreover, the actual NPVs are difficult to interpret because they are calculated in current prices of the year they refer to. And last, but not least, no matter how accurate our calculations, they are subject to error and missing data which can alter the exact numbers. But since these errors are likely to apply in the same way to all fields, they are not expected to significantly change the rankings.

For all these reasons, we have standardised the results: we set the average NPV equal to 100 in each country and compared how each of the four fields compares to the average.

All in all, our methodological choices do not come without limitations. One is that we regroup faculties in order to have larger sample sizes, with the consequence that we cannot distinguish a graduate in law from a graduate in political science. Existing research indicates that disparities also exist when rankings the top-earning fields, also by gender. Chevalier (2011) observes also that in the UK, women tend to earn less than men – in terms of income – in the fields with the highest returns. Indeed, male graduates from Economics, Law, IT and subjects related to medicine have significantly

[14] The latter strongly dominates in the group in terms of the number of observations. The only category that presents a concern in terms of sample size is that containing male graduates in Education, Arts & Humanities.

higher earnings than women with the same majors, whereas women have higher earnings in Education, Linguistics, History and Philosophy. Similar disparities are observed in Slovenia (Bartolj et al. 2012) and Germany (Wahrenburg & Weldi 2007).

4. Results and discussion

To demonstrate a baseline of the current state of the art, we extracted from the OECD data current estimates of the net present value of tertiary education for the five countries we also study (see Table 3). As shown in the previous section, these are probably the most detailed and sophisticated returns to tertiary education calculated for a larger sample of countries.

Table 3. Average net present value of tertiary education in 2008 (euros)

Country	Private returns	
	Men	**Women**
France	70,129	59,285
Hungary	48,263	56,721
Italy	72,302	74,010
Poland	36,764	47,335
Slovenia	61,921	60,879

Note: The net present value for an individual obtaining tertiary education as part of initial education (2008 or latest available year). Converted from equivalent USD using PPPs for GDP.

Source: OECD (2012).

As we can see, the net present value of tertiary education exhibits significant differences not only between countries, but also between genders. Interestingly, the new member states are NOT visibly different from the older member states apart from the gender.

We now proceed to examine, using our own analysis, how inclusion of additional data and a break-down of students according to their field of study changes the picture.

Figures 1 and 2 present private returns for males and females in different fields of study. The charts show that a good degree of heterogeneity emerges as soon as we stop looking at university graduates as a homogeneous group, especially for men in France and Italy.

For a male young school graduate, enrolling in education and humanities is, relatively speaking, not an advantageous choice. Somewhat surprisingly, the same applies, although to a lesser degree, to STEM. Why is this the case? We observed that different fields not only result in more or less higher salaries after university, but also that costs can change. In particular:

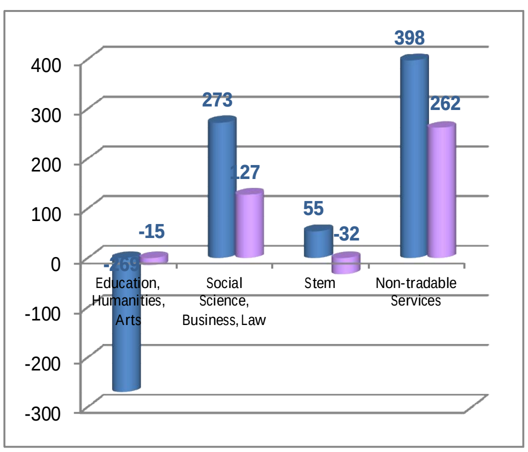
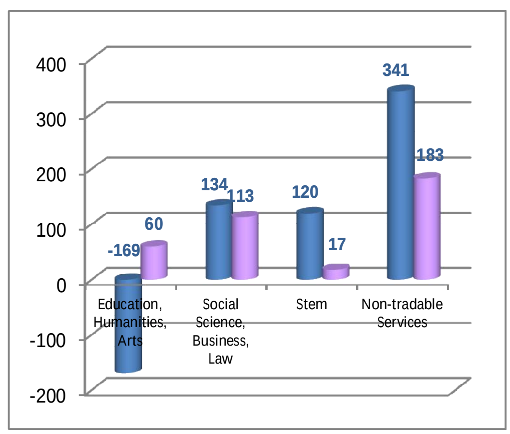
- Study hours are different because some subjects are more demanding in terms of personal study time and class attendance;
- Hours for student jobs differ, partly as a consequence of hours spent studying; and
- The number of years necessary to graduate can change.

The ‘STEM case’ is clear in two countries – in Italy and France, the lower return is a result of high costs rather than low benefits. In Italy, increased costs are due to the duration of studies, which is not fixed as in other countries; in France instead it is determined by high average hours spent studying or attending classes per week, higher compared to other fields.

In France and Italy, students are better off studying health and related services. In contrast, in the Central and Eastern European countries, the fields of study with the highest return are social sciences/business/law in Hungary, Slovenia and Poland (in the latter with the same return as STEM).

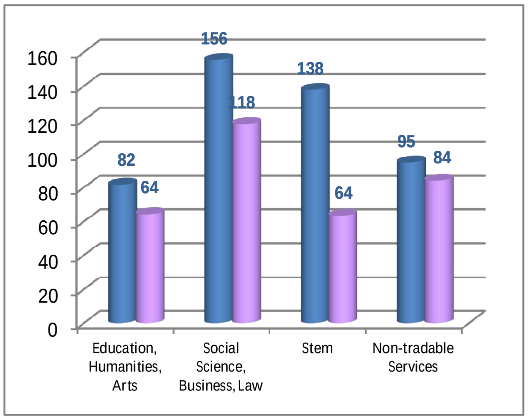
This implies that the recent success of faculties like economics, business or law is consistent with high private returns, especially in Central and Eastern Europe. Some studies offer an explanation for this success. For example, Münich, Svejnar & Terrell (2005) investigate the shift in the returns to education in the Czech Republic between 1989 and 1996, namely the transition away from a specific structure of labour market characterised by very low rates of returns on education, a low proportion of university graduates and a strong bias towards industrial skills. They find that along with a substantial increase in returns, a considerable redistribution among fields of study took place. In contrast to the experience in Western Europe, returns associated with qualifications underrepresented during the Soviet period, e.g. social studies, law and business studies, became higher than returns on technical skills. This is especially marked for law, becoming the most rewarding qualification, as a consequence of the high demand for legal services during the period of privatisation and restructuring. The same happened in Slovenia according to Bartolj et al. (2012).[15]

Figure 1. Net present value of university education in five countries, five years from graduation, male graduates

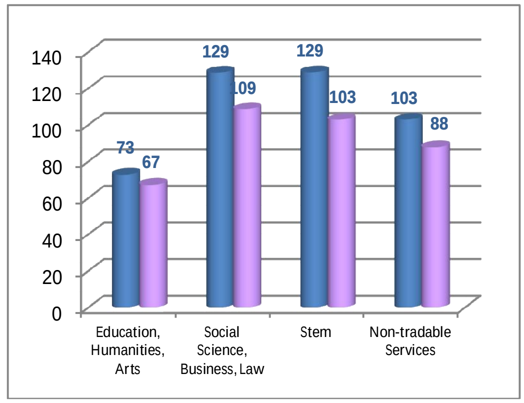
Italy	France
	

15 More recent studies observe that the gap between the rates of return of social sciences and technical fields is now small and that educational expansion in Eastern Europe is increasing faster today than justified by demand.

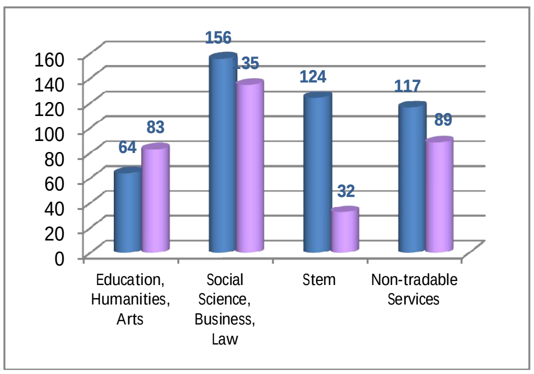
Hungary



Poland



Slovenia



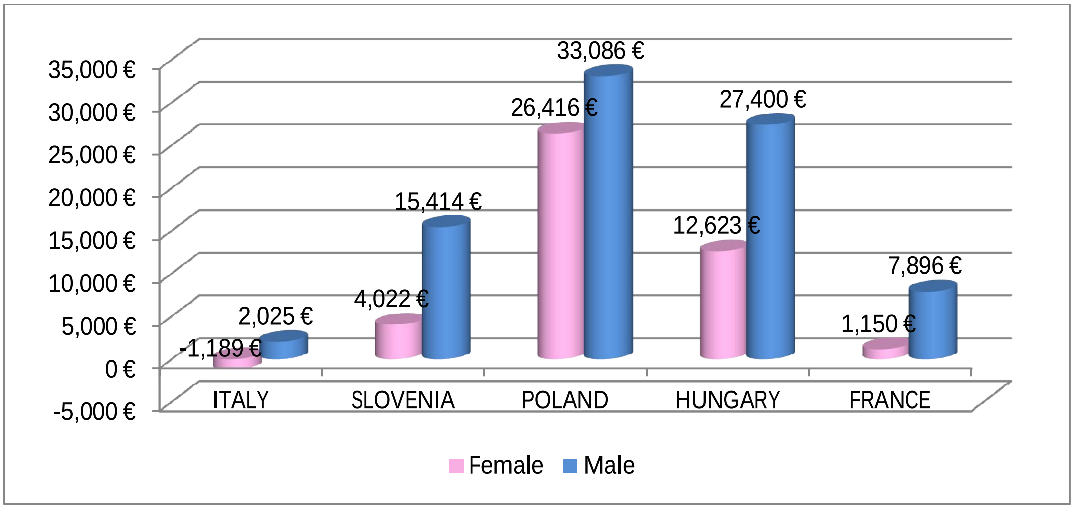
Source: Authors' elaboration based on HEGESCO / REFLEX datasets.

This first part of the analysis indicates therefore that when both costs and benefits are taken into account, social sciences and medicine (and related professions) tend to have the highest private returns across the five countries studied.

Machin & Puhani (2003) stress that in this type of research (as in many other labour economics topics) it is important to distinguish by gender. Our results, shown in Figure 1, suggest first of all that the labour market for female graduates is subject to a lower degree of inequality compared to men, especially in Central and East European countries.

Our results also confirm the findings in the literature on segregation which can be observed on the one hand in the male / female dominance of certain fields, and on the other in the difference in NPVs for the same field. Female graduates dominate the class 'education, arts and humanities', for which they enjoy higher returns compared to men. For a woman, enrolling in STEM courses is rarely the most financially rewarding choice. In Italy, France Slovenia and Hungary, it brings the lowest returns. This is consistent with and perhaps also explains the low female participation in STEM. According to some authors (Hall 2007; Hewlett et al. 2008), this is due to long working hours, a macho culture and not altogether transparent career paths. Hunt (2012) argues instead that it is because of dissatisfaction over pay and promotion opportunities. Our data indicate that there is a clear wage gap and therefore provide support for the latter hypothesis.

Figure 2. NPV of tertiary education for STEM graduates, male and female compared



Source: Authors' elaboration based on HEGESCO / REFLEX datasets.

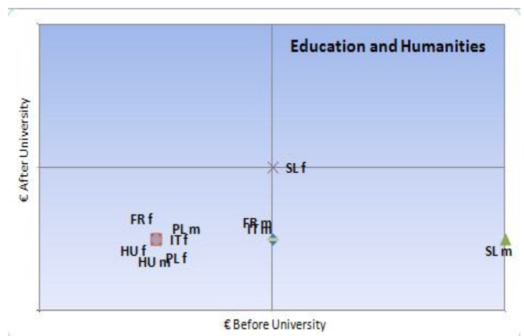
In terms of ranking, social science is always a good choice, especially in Central and Eastern Europe, but so are health & related services in France and Italy. Poland constitutes an exception in the group: not only has the country achieved a good level of convergence, even for STEM faculties, but returns are the same as for social sciences and are similar for men and women.

In the remainder of the section, we disaggregate costs and benefits[16] of tertiary education by field in each of the five countries considered and rank them. What determines the position of each dot in the scatter plot is not the absolute value in euros but rather the ranking by country. For example, in Italy, the costs for male graduates are in order, from lowest to highest: NT services, social science, humanities and STEM and therefore are equal to, respectively, 1,2,3,4. Similarly for benefits, where the most rewarding subject is NT services (and therefore is equal to 4) and the least, humanities (equal to 1). We regroup this information by field rather than by country and show them in Figure 3.

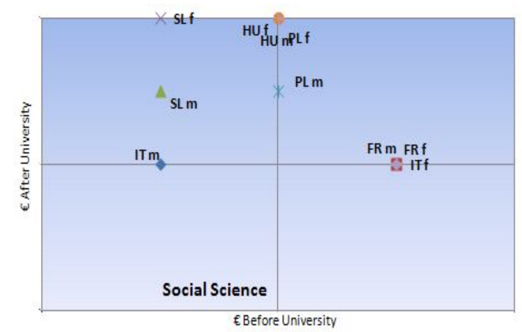
[16] Both undiscounted.

Figure 3. Costs and benefits of education compared

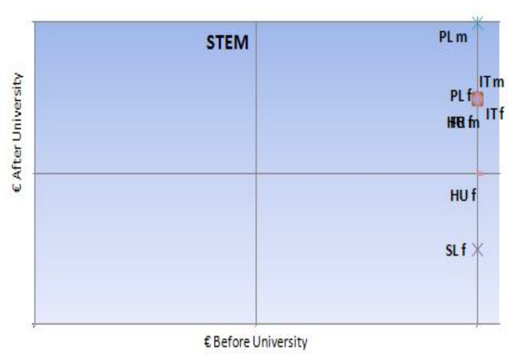
Education, Arts & Humanities



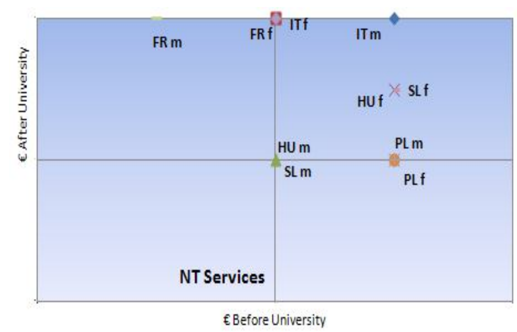
Social Sciences



STEM



Health & related Services



Source: Authors' elaboration based on HEGESCO / REFLEX datasets.

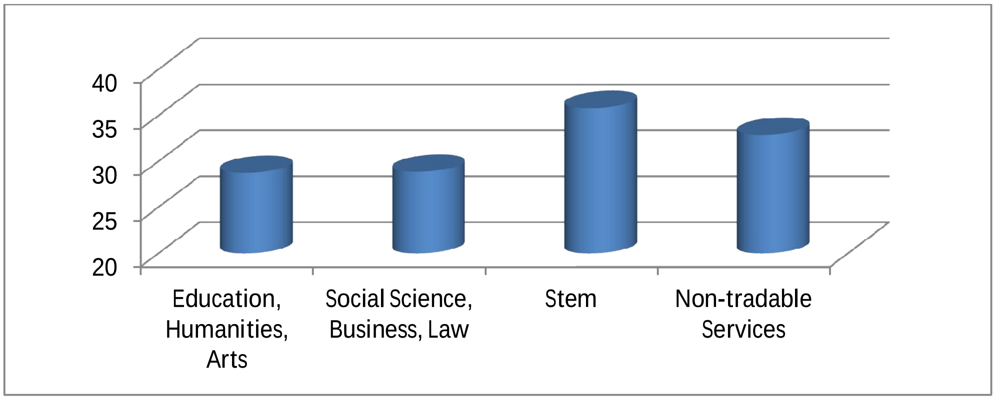
According to the ranking, four outcomes are possible:

- A degree costs relatively little but also provides a low return: this is almost always the case with education and humanities.
- A degree has high costs, but also provides high returns: STEM more often falls in this category.
- Social sciences usually involve good returns for a low initial investment, especially in Central European countries.

It is not an ambition of this paper to explain why such differentials exist. We primarily wanted to point out that once a more sophisticated calculation of costs and benefits is done, then private returns to different fields might appear more consistent with private choices.

However, we can briefly indulge in informed speculation about what is the underlying cause of such heterogeneity within fields. According to the literature, one explanation for the observed heterogeneity is that different fields serve a signal purpose. This sorting effect implies that more able students will place themselves into fields that are assumed to be more demanding and earn more for this reason after they graduate. The different allocation of hours to study and student jobs support this view.

Figure 4. Hours studied (classes plus personal work) by faculty (average for the five countries)



Source: Authors' elaboration based on HEGESCO / REFLEX datasets.

Students who, despite the overall NPV, decide to enrol in STEM could therefore be wealthier or smarter (or both). A downside of this is that less accessible faculties (in terms of high initial costs) may restrict the participation of non-wealthy students. In a comparative study between France and Germany, Duru-Bellat et al. (2008) show that educational expansion implies a division between elites and the mass population in the sense that if fields are academically demanding or more costly in terms of length of study, social background effects are particularly likely to be a factor. Alternatively, those who still enrol in STEM programmes, despite the high cost, are notably risk-adverse given that they anticipate positive labour market outcomes (for the males) but also know their abilities and estimate that they can cope with the challenge.

5. Conclusions

The subjects that university students actually study have been the object of extensive attention by the public and policy-makers at both national and European levels. Due to the 'massification' of higher education, the question "what to study" is steadily replacing "whether to study" as the key question facing young people today. Apparently an 'excessive' preference for 'soft' subjects at the expense of 'hard' ones, despite supposedly better employment and pay prospects of the latter, and the need to boost numbers of graduates in science, technology, engineering and mathematics, particularly for women, has been acknowledged even in high-level EU strategies and European Council conclusions.

This paper examines, in a comparative and methodologically innovative manner, incentives for studying various fields measured by private returns to education. We use data from five European countries (France, Italy, Hungary, Poland and Slovenia).

We contend that the current research examines only part of the equation because it tends to look at only some of the benefits (employment prospects and salaries of graduates). Private returns to education should include a broader set of variables. The key one is the different cost of study to students in terms of time, either in terms of study hours or years in education, both with a strong negative impact on the opportunity cost of university education.

Factoring in time helps to explain why in the short- to medium-term after graduation, STEM careers do not make as much financial sense as headline numbers seem to suggest. Moreover, from a gender point of view, private returns for STEM are consistently lower for females than for males in a given country.

We also distinguish the private costs and benefits into before/after graduation components. We saw that both females and males view STEM as fields with high initial costs, but males tended to see high return after graduation, which was much less typical for females. This provides a rational explanation for the smaller interest shown by females in the STEM fields. It also suggests that a potentially powerful way to increase female interest in STEM fields lies in examining the sources of smaller post-graduation rewards or post-diploma incentives to lower the cost of enrolling in STEM programmes.

On the other hand, some, but not all of the 'soft' subjects have very high total private returns. They combine low initial costs (since they allow working on the side) with substantial later returns. This observation applies to a group of subjects such as social science, law and business, but not arts, humanities and education, where the private returns tend to be much lower. This is particularly true for the new member states where generic skills represented by such degrees are a good fit for a rapidly changing economy.

The fourth category we examined – health & related services – concerned mostly, but not exclusively, health care and social welfare and provided a consistent picture of medium overall returns stemming from high initial costs, but high subsequent benefits.

Overall, despite limitations, the results appear to be sufficiently robust to demonstrate that a comprehensive investigation of elite vs. mass private returns to education by field of study can help explain decisions made by students on a rational basis. This insight points to the fact that if policy-makers desire change in behaviour, they should consider changing the incentives (i.e. the costs and benefits) themselves. Conversely, the fact that there are sound economic grounds on which students choose their field of study clearly indicates that one should not expect to bring about major changes in enrolment decisions based solely on the strength of providing more information on the benefits of STEM careers.

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